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November 27, 1996

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: ET Docket No. 95-177

Dear Mr. Caton:

Please be advised that the Critical Care Telemetry Group sent the attached Engineering Statement today to Richard M. Smith, Michael J. Marcus, Karen Rackley, Lynn Remly, and Anthony Serafini. Two copies of this statement are hereby submitted for the public record in this proceeding pursuant to 47 C.F.R. § 1.1206(a)(1).

If there are any questions regarding this matter, please contact the undersigned.

Sincerely,

Daniel S. Goldberg

Attachment

cc: Richard M. Smith
Michael J. Marcus
Karen Rackley
Lynn Remly
Anthony Serafini

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PHILIP A. RUBIN & ASSOCIATES, INC.
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ENGINEERING STATEMENT

The Commission, in response to a petition for rule making submitted by the Critical Care Telemetry Group ("CCTG"), has proposed to permit operation of Biomedical Telemetry Devices ("BTDs") on VHF frequencies 174 - 216 MHz (television channels 7 through 13), 470 - 608 MHz (television channels 14 through 36) and 614 - 806 MHz (television channels 38 through 69). During an October 16, 1996, meeting between the representatives of CCTG and the Commission staff regarding the proposed rulemaking, the Commission requested that CCTG provide additional information regarding the following issues: (1) data on the gain characteristics of typical BTD antennas; (2) the appropriateness of the "Data PCS" frequencies (2390 - 2400 MHz) for biomedical telemetry use; and (3) the impact of an alternate frequency allocation plan for Advanced Television ("ATV") submitted by Maximum Service Television's ("MST") on the availability and use of UHF television frequencies for biomedical telemetry. This Engineering Statement addresses these issues and provides further support for CCTG's proposal.

Gain Characteristics of BTD Antennas

In its previous submissions to the Commission, CCTG noted that antennas employed by most BTDs to transmit patient specific telemetry signals were inefficient, having gains ranging from -20 dBi to 3 dBi, with the latter being achieved only by use of a table top antenna. During the October 16, 1996, meeting, the Commission requested that CCTG provide additional information regarding typical gain characteristics and efficiencies of BTDs.

In response, The Hewlett-Packard Company ("HP"), a CCTG member and a current manufacturer of biomedical telemetry units, examined data relating to the antenna gains associated with its telemetry transmitters — which use ECG patient leads as antennas — operating between 460 and 470 MHz. Based on this data, HP determined that typical gains from its BTDs are -14 dBd (-11.85 dBi). These gains are partially attributable to absorption by the human body, to which BTDs are normally attached.

As further support for the proposition that BTDs are inherently inefficient, Spacelabs Medical, Inc., another CCTG member, tested its units at EMC Northwest, a certified testing facility in New Berg, Oregon. Spacelabs compared the signal strength of its units operating on VHF frequencies when worn by middle aged men to that obtained when they were operated on a non-conducting surface and positioned for optimum radiation. These measurements were taken when the human subjects were positioned both standing and supine and rotated through 360 degrees horizontally. Measurements were taken as the receiving antenna was varied in height from 1 to 4 meters in both horizontal and vertical polarization. The range of lowest attenuation values for each subject is listed below :

Frequency (MHz)	Range of Attenuation Due to the Body (dB)
174.0125	10.7 - 16.4
192.0125	15.1 - 17.9
214.9875	9.6 - 17.0

The average attenuation value is approximately 3 dB greater.

As demonstrated by the data developed by HP and Spacelabs regarding their respective BTDs, the typical antenna used in biomedical telemetry devices exhibits a negative gain.

Operation of BTDs at 2390 - 2400 MHz

In the October meeting between the Commission and representatives of CCTG, the Commission requested further comment from CCTG regarding the suitability of the Data PCS frequency band (2390 - 2400 MHz) for biomedical telemetry use. As discussed below, the Data PCS band is ill-suited for biomedical telemetry use.

First, the human body is highly absorptive of RF energy at this frequency. HP has conducted tests demonstrating that if an ambulatory patient collapsed and fell on a transmitter operating at this frequency, the signal would be attenuated by approximately 30 dB. This attenuation would result in a signal loss at a critical time for the patient and, therefore, is unacceptable.

In addition, available data PCS systems are designed to have an indeterminate latency period. By contrast, a short latency period is a key requirement for critical care telemetry systems. The latency period in the context of a critical care telemetry system is the time that it takes for an alarmable event, *e.g.*, a dangerous arrhythmia, to trigger an alarm. International standards require that a latency period for a cardiac monitoring system be no greater than 10 seconds.

Because of the time requirements of other elements of a cardiac monitoring system, including the time for arrhythmia-detecting algorithms to operate, most medical equipment manufacturers believe that 1 second is the maximum acceptable latency period for the wireless link. Available data PCS technology cannot always meet this specification, and designing and manufacturing wholly new data PCS systems for the relatively small market for critical care telemetry transmitters is economically infeasible.

Finally, data PCS systems are designed to operate in laptop computers and other devices with relatively large batteries and physical dimensions. Critical care telemetry transmitters, however, must be very small and have long battery lives to make them practical for continuous, long term use by seriously ill patients. Using data PCS type transmitters would require patient devices about 3 times as large as the currently available VHF and UHF transmitters with about 10% of the battery life. This is unacceptable in a critical care environment.

MST's Proposed ATV Spectrum Allocation Plan

In October 1996, Philip A. Rubin & Associates, Inc. ("PAR") submitted an engineering statement which discussed the impact of the Commission's August 1996 draft channel allocation plan for advanced television[1] on the availability and use of the UHF TV frequencies for biomedical telemetry. In its analysis, PAR analyzed the availability of UHF television channels for biomedical telemetry after the proposed allocation of one new 6 MHz channel to each existing television licensee. The statement concluded that in the 20 major television markets excluding, San Francisco, there would be at least two UHF television channels within channels 20 to 50 on which operation of biomedical telemetry systems would be possible while maintaining a 113.2 kilometer co-channel separation distance from television licensees. In San Francisco there would be one channel available. The analysis also noted that VHF TV and other UHF TV channels below 20 or above 50 might also be available.

This Autumn, MST submitted to the Commission its own ATV allotment plan. PAR analyzed the availability of UHF television channels for biomedical telemetry based on the proposed MST allotment plan and compared it to the results obtained from analyzing the FCC's August 1996 ATV allotment plan. The following criteria were used for both studies:

- The top 20 television markets were considered.
- A single latitude and longitude was used for each market.

[1] Sixth Further Notice of Proposed Rulemaking, MM Docket No. 87-268, 11 FCC Rcd. 10968 (1996).

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• Only channels 20 - 50 were considered, both NTSC and ATV.

• The criteria for availability — If a channel/station is further than 113.2 kilometers from the market area, then that NTSC channel and allotted ATV channel are "available."

The FCC's August 1996 allotment table supplied no latitude and longitude information. Therefore, a latitude/longitude association had to be made. For PAR's October study, the latitude and longitude from an allotment table proposed by the Commission in May 1995 was used.[2] The MST plan also contained no latitude/longitude information. In this case the association was made using the latest FCC television database. This different method was used because there were 71 allotments with no match when using the May 1995 plan. The non-matching stations were proposed for authorized facilities, except for one which was licensed.

The attached Exhibit 1 summarizes the results of the analysis of MST's proposed allocation scheme. As evident from this exhibit, under both the proposed MST plan and the FCC August 1996 allotment plan, there will be at least two UHF frequencies available for use by biomedical telemetry in all markets studied, with the exception of San Francisco in which there will be one available channel.

A. Khalilzadeh

November 27, 1996

Attachment

2 Memorandum Opinion and Order, Third Report and Order, and Third Further Notice of Proposed Rulemaking, MM Docket No. 87-268, 7 FCC Rcd. 6924, 6926 (1992).

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EXHIBIT 1

VACANT CHANNEL AVAILABILITY (BETWEEN 20 - 50)

New York, New York
MST Allotment - 20 22 26 29 30 32 35 38 46 48
FCC Allotment - 20 26 29 30 32 35 46 48

Los Angeles, California
MST Allotment - 20 23 31 42 43 45
FCC Allotment - 20 23 29 39 42

Chicago, Illinois
MST Allotment - 22 24 28 30 33 34 35 36 39 40 42 45 46
FCC Allotment - 22 24 28 30 33 34 35 36 39 40 42 45 46

Philadelphia, Pennsylvania
MST Allotment - 22 24 27 28 31 33 34 36 41 44 45 47 50
FCC Allotment - 20 22 27 28 33 38 41 42 44 45 47

Detroit, Michigan
MST Allotment - 22 23 26 27 32 35 39 41 47 48 49
FCC Allotment - 22 23 26 32 35 39 40 46 47 48 49

Boston, Mass.
MST Allotment - 22 26 29 33 35 40 42 45
FCC Allotment - 26 29 31 35 40 42 45

San Francisco, California
MST Allotment - 46
FCC Allotment - 46

Cleveland, Ohio
MST Allotment - 22 24 26 30 31 32 35 38 40 42 44 50
FCC Allotment - 22 24 26 30 32 35 38 40 42 44 50

Washington, DC
MST Allotment - 21 23 25 28 31 33 42 46 47 49
FCC Allotment - 21 23 25 27 31 42 43 44 47 49

Pittsburgh, Pennsylvania
MST Allotment - 20 23 25 30 32 39 41 43 44 47 48 49
FCC Allotment - 20 23 31 32 35 39 41 44 47 48 49

St. Louis, Missouri
MST Allotment - 20 22 23 25 27 28 29 31 32 33 36 38 40 42 43 44 45 48 49 50
FCC Allotment - 20 22 23 25 27 28 29 31 32 33 36 38 39 40 42 43 44 45 49 50

Dallas/Fort Worth, Texas
MST Allotment - 20 22 25 26 28 30 34 40 42 44 48
FCC Allotment - 20 22 25 26 28 34 40 44 48

Minneapolis, Minnesota
MST Allotment - 20 21 24 25 31 35 36 39 42 43 46 47 48 49
FCC Allotment - 20 24 25 31 35 36 38 39 42 43 46 47 48 49

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EXHIBIT 1

VACANT CHANNEL AVAILABILITY (BETWEEN 20 - 50)
(Continued)

Baltimore, Maryland		
MST Allotment	-	21 23 25 28 31 42 46
FCC Allotment	-	21 23 25 27 31
Houston, Texas		
MST Allotment	-	21 23 25 28 29 31 33 34 36 40 43 50
FCC Allotment	-	21 23 25 33 34 36 40 50
Indianapolis, Indiana		
MST Allotment	-	22 24 26 28 31 32 33 34 36 38 39 41 43 45 48 50
FCC Allotment	-	22 24 26 28 31 33 34 36 38 39 41 43 45 48 50
Cincinnati, Ohio		
MST Allotment	-	21 23 24 25 27 30 32 35 36 38 40 42 46 47 49
FCC Allotment	-	21 23 25 27 32 35 36 38 40 42 44 46 47 49
Atlanta, Georgia		
MST Allotment	-	21 22 23 24 26 29 32 33 35 38 40 41 43 44 47 49
FCC Allotment	-	21 22 24 29 32 33 35 38 40 41 44 47 49
Hartford, Conn.		
MST Allotment	-	21 23 25 34 41 44 45
FCC Allotment	-	21 23 25 28 31 33 34 38 44
Seattle/Tacoma, Washington		
MST Allotment	-	21 24 25 27 29 31 34 36 38 40 42 43 46 47 48 49
FCC Allotment	-	21 26 29 30 31 34 36 38 40 42 46 47 48 49